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THE ASSOCIATION OF TEACHERS OF MATHEMATICS IN NEW ENGLAND.

FINAL REPORT OF THE COMMITTEE ON THE MATHEMATICS OF THE PRE-HIGH SCHOOL GRADES.

In submitting the final report of the committee appointed by the council of this association in May, 1914, "To investigate the mathematical program of the grammar grades throughout New England," we desire to call to your attention the conclusions as stated in our first report which was presented before this Association in May, 1915.

They are stated therein as follows:

1. That, while there has been a tendency during the last decade to eliminate certain obsolete topics and to simplify the treatment of certain others retained, there is still a need in certain sections of New England, (1) to eliminate topics like the following: troy weight, apothecaries' weight, surveyors' measure, longitude and time, present worth, exchange, compound and partitive proportion, compound partnership, average of payments, problems dealing with the indirect cases of interest, cube root, and the mensuration of frustums, (2) to curtail and simplify the treatment of interest—especially annual and compound, partial payments, bank discount, stocks and bonds, taxes, and insurance.

2. That in connection with the treatment of the two major topics in these grades, viz., percentage and mensuration, there is an excellent opportunity and a need to make the arithmetic work real and vital.

In the case of the former topic (percentage) by a presentation made more simple, exact, and definite by the use of concrete materials such as: list prices of articles bought and sold, sales' slips, industrial reports, bank checks, notes, etc., and by having the pupils devise, propose, and solve simple practical problems dealing with these materials and situations thus objectified.

In the case of the latter topic (mensuration) by emphasizing drawing to a scale, the matter of approximating results, and the meaning of such approximations with respect to the degree of accuracy attainable with the data used.

3. That there is real need for emphasizing oral or mental arithmetic in these grades. Such oral work not to be limited to the field of pure number work alone but to include problem work as well.

4. That in these grades the aim should be not merely for a mastery of the mechanics of arithmetic but for the attainment of some degree of skill in calculating. By skill is meant the ability to get a correct numerical result in the most economical way and to be able to check it approximately or definitely as the conditions may permit.

5. That there is little sentiment among teachers of the eighth grade favoring the introduction of work of an algebraic nature in that grade but that many desire a program providing a minimum amount of arithmetic for all pupils and some additional topics for the most capable pupils.

Since the presentation of our first report, sub-committees, consisting largely of grammar school teachers especially interested in arithmetic, have been at work in Springfield, Worcester, and Boston, under the leadership of individual members of this committee, criticizing and revising the program of mathematics for grades 7 and 8 which was formulated on the basis of the above conclusions.

All of the above conclusions this committee again endorses and submits for your consideration and adoption the conclusions as stated with the following program of mathematics for grades 7 and 8 as they are now generally constituted throughout New England.

Material 1. Problems employing assigned numbers.
2. Problems employing numbers obtained by measuring.
3. Percentage work—concrete materials such as: list prices, sales' slips, industrial reports, local and city budgets, bank checks, notes, etc.
4. Simple numerical equations involving (*a*) division and (*b*) multiplication leading to the statements of the work and results in equational form, *e. g.*,
    a. If oranges are sold at 36 cents per dozen, find the cost of one orange.
    b. If one quarter of a pound of tea costs 25 cents, find the cost of one pound.

Solutions:
a. $12x = 36$
$x = 1/12$ of 36, etc.
b. $x/4 = 25$.
$x = 4 \times 25$, etc.

OUTLINE.

Seventh Grade.

1. Fundamentals of percentage.
    a. The per cent idea as,
        (1) A rate per hundred.
        (2) A number of hundredths.
    b. The ratio of numbers expressed as per cents with simple problems of application.
        (1) Games and scores.
        (2) School data.
        (3) City and governmental reports.
        (4) Gain and loss per cents in business transactions.
    c. Finding per cents of numbers with simple problems of application.
        (1) Games and scores.
        (2) School data.
        (3) City and governmental reports.
        (4) Single discounts in the business world.
        (5) Commissions on a percentage basis.
        (6) Simple Interest.
2. The simple equation.
    a. Axioms.
        (1) Division.
        (2) Multiplication.
        Note: Work to be introduced by problems which require for their solution one or both of the above axioms.
    b. Applications.
        (1) Percentage formula, *i. e.*,
        $p = b \times r$.

Eighth Grade.

1. Extended applications of percentage.
    a. Buying and selling.
        (1) Store problems.
            (*a*) Single discounts reviewed.
            (*b*) Successive discounts.
        (2) Commission.
            (*a*) Percentage basis.
                (1) General business.
                (2) Brokerage.
                (3) Real estate.
            (*b*) Number basis.
                (1) General business.
                (2) Brokerage.
    b. Compound interest as related to personal accounts in Savings Banks.
    c. Partial payments as related to mortgages and purchases on the instalment plan.
    d. Taxes.
        (Local applications to city budgets, etc.)
    e. Insurance as related to homes.
2. Indirect problems in percentage.
    a. General formula, *i. e.*,
        $b = p/r$.
    b. Marking goods.
        (1) Where per cent gain is reckoned on receipts.
        (2) Providing for discounts.
        (3) Providing for anticipated losses.

(2) Simple interest formula, *i. e.*,

$i = p \times r \times t$.

3. Mensuration.
    - *a.* Measurement and relation of lengths and distances. (Use foot rule.)
        - (1) Number field.
            - (*a*) Numbers assigned.
            - (*b*) Numbers obtained by counting.
            - (*c*) Numbers obtained by measuring.
        - Note: Distinction made between degree of accuracy obtainable and that desired for a given practical purpose.
    - *b.* Measurement and ratio of angles with application to slopes and grades, intersections of streets, etc. (Use protractor.)
    - *c.* Perimeters of plane figures.
        - (1) Square, rectangle, parallelogram, triangle, trapezoid, and circle.
        - (2) Application and use of formulas.
    - *d.* Areas of plane figures.
        - (1) Square, rectangle, parallelogram, and triangle.
        - (2) Application and use of formulas.

3. Mensuration.
    - *a.* Area of trapezoid and circle.
    - *b.* Surface and volume of: cube, rectangular block, prism, and cylinder.
    - *c.* Problems of application.
4. Ratio and simple proportion.
    - *a.* Proportion expressed as an equality of two fractions.
5. Thorough reviews — oral and written—on the fundamentals of arithmetic.

Note.—The field of applications of mensurational work should be enlarged by the use of hectographed figures the dimensions of which are to be determined by the pupil by measurement.

It has been our purpose, as stated in our first report, to investigate and summarize the opinions of representative teachers of mathematics in the grammar grades throughout New England as to *content* and *method* in the mathematics work of these grades.

It is on this basis that the above program is submitted.

In conclusion we may state that the teachers of mathematics in the grammar grades believe, (1) that nothing will be gained in the mathematics work of these grades by teaching formal algebra as such, (2) that the presentation and treatment of the topics included in this outline should be simple, exact and definite, (3) that pupils should be led to depend upon their own reasoning powers, (4) that oral work should have a place in every recitation, (5) that in written work of a mechanical nature an effort should be made to develop real mathematical calculation and that in applied work pupils should be taught and held responsible for simple schematic ways of arranging the work so that it can be easily reviewed, (6) that the topics included herein while providing a minimum amount of work for all pupils will also provide by extended applications a maximum amount for the most capable pupils.

This committee desires to acknowledge its indebtedness to the many teachers of the grammar grades throughout New England—especially in Springfield, Worcester, and Boston—who in committee meetings and in other ways, have given generously of their time and thought to the consideration and discussion of the Program herewith presented.

Respectfully submitted,
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In the discussion by members of the association of the motion that "the report of the committee on the mathematics of the pre-high school grades be accepted and the committee discharged with the thanks of the association," it was the desire of the association to append with its endorsement the following suggestions of improved methods to be recommended to the teachers of mathematics in these grades:

1. That in mensuration, a foot-rule giving two scales on the opposite edges of the same stick be used—the one scale showing the foot subdivided into tenths and hundredths, the other showing the usual subdivisions—so that the field of applied work in decimal fractions may be materially enlarged and sensible approximations in computations duly emphasized.

2. That in the seventh grade, multiplication in which the figures of the multiplier are used in the reverse order from that of the present be taught in order that the pupil may come naturally to approximate his final product at the outset. It is the hope of this association that this method may soon be the only method of multiplication presented in the grades.